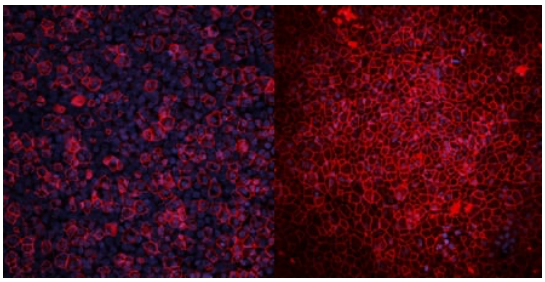
Australian scientists grow replica human lungs and call for end to animal testing



This article is more than 6 months old An unhealthy ‘mini lung’ (left) and a healthy one. Photograph: University of Sydney

When Chrzanowski moved to Australia from Poland to establish a nano-bioengineering group at the University of Sydney 13 years ago, he organised a seminar on bio-printing, a concept similar to 3D-printing where cells are taken from a patient and then cultivated to produce enough “ink” to print models of tissues for medical research. Drugs and disease mechanisms can be studied and tested in these lab-printed models, rather than on animals.

In April, Chrzanowski and his colleagues published a paper in the peer-reviewed journal Biomaterials Research about a technology that goes even further than bio-printing. They have successfully grown replica human lungs in their laboratory at the University of Sydney Nano Institute, where Chrzanowski is now deputy director. Their scientific paper even includes instructions on how to grow them. At just a few millimetres wide, the “lungs” have little resemblance to those of humans. They are contained in a plastic tube, and when you look into the tube from above, the lungs resemble a small blob of jelly spread across a thin membrane.

“These plastic cages are placed into an incubator where the lungs are fully monitored all of the time,” Chrzanowski said.

“We need to know that the lungs have grown enough to be ready and matured for testing. So we developed what we call a ‘smart lead’ with electrodes, which sits continuously above the lung models and monitors the bioelectrical signals of the lungs. Based on these signals we can say when the lungs are fully matured and are ready to start treatment. It is same as hooking up a monitor to a patient and checking for their heart beat. So this biosensor we developed also helps us observe when, for example, a treatment is working and the injured lung is regenerating.”

However, there are limitations to Chrzanowski’s model lungs. When testing a drug or treatment on a human, the drug may affect various parts of the body, such as the lungs, gut, heart and brain. This whole-body response is impossible to study using only the model lungs. Chrzanowski hopes to build multiple organs, connect them, and have them communicate and function together. But this work is decades away, with even the widescale use of model lungs for research still at least five years down the track, Chrzanowski said. Each lung takes 28 days to grow in the lab. “It has not been simple to get to this point, and it has taken us years to get to where we are, and engineer for example the smart leads,” he said.

“But in terms of building the lungs, any person with basic skills in cell culture will be able to do this. Undergraduates could run a lab of these lungs. We are entering an era of replacing animal research and we are going to see rapid acceleration of that. People, governments, pharmaceutical companies, are realising the need to invest in this.”

Other countries are more advanced in using lab-grown models of human organs than Australia, Chrzanowski said. In January, a law was introduced in the US which means it is no longer required that pharmaceutical companies test new drugs on animals before human trials can occur. In Europe, dedicated funding is allocated towards producing innovative, non-animal technologies for testing drugs and studying disease.

But developments are happening in Australia. Last year, the New South Wales government held an inquiry into the use of primates and other animals in medical research. Chrzanowski presented to the inquiry, highlighting the inconsistency of results from animals, especially when laboratory conditions vary.

But the final report from the inquiry made no recommendations to stop primate experimentation, and found current technologies were not yet ready to replace animal testing. The report said: “At this point in time, it appears that it is more accurate to describe the emerging methods as adjuncts to, rather than alternatives or substitutes to the use of animals in medical research.”

The committee did call for the rapid phasing out of two specific medical research experiments – the use of rodents in forced swim tests and in smoking tower tests. And grants have since been established to support alternatives to animal research.

“In conjunction with the CSIRO, we are developing a strategy for Australia towards non-animal research,” Chrzanowski said. “Every single university should be developing labs and centres to non-animal models. They are reliable. They are rapid, and accelerate research discovery and translation. The results are reproducible. And these models are also cheaper than testing on animals. So with this in mind, why aren’t we already investing in these model and using them? The rest of the world is galloping ahead of Australia in this space.”

Adapted from https://www.theguardian.com/science/2023/apr/11/australian-scientists-grow-replica-human-lungs-and-call-for-end-to-animal-testing

Match the word with its definition.

1. cultivated	A. Pertaining to something that occurs or is applied on a wide area or population.
2. incubator	B. connecting or linking one thing to another.
3. hooking up	C. The gradual reduction or elimination of something over time.
4. widescale	D. A lack of uniformity or stability.
5. funding	E. Things or elements that are added to or associated with a primary system.
6. inconsistency	F. The process of growing or developing something, often in a controlled environment.
7. adjuncts	G. Financial support or resources provided for a particular purpose.
8. phase out	H. A device or system used for maintaining a specific environment.

True False : Answer the following true or false questions based on the information in the provided text and justify your response.

1. Bio-printing is a concept similar to 3D printing. **True** **False**

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2. The replica human lungs grown in the laboratory are several centimeters wide. **True** **False**

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3. The "smart lead" with electrodes is used to monitor the bioelectrical signals of the model lungs. **True** **False**

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4. Dr. Chrzanowski's lab-grown model lungs can accurately simulate the whole-body response to a drug or treatment. **True** **False**

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5. The development of multiple organs that can communicate and function together is expected to happen within the next few years. **True** **False**

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6. The use of model lungs for research is at least five years away from widescale adoption. **True** **False**

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7. The final report from the New South Wales government inquiry recommended a complete ban on primate experimentation in medical research. **True** **False**

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8. Dr. Chrzanowski believes that non-animal research models are more reliable, cost-effective, and reproducible than testing on animals. **True** **False**

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Fill in the gaps with the appropriate phrasal verbs: look into, set up, carry out, come up with, take on, break down, get to, call for.

1. The committee _____ the rapid phasing out of specific medical research experiments.
2. It has taken us years to _____ where we are and engineer the smart leads.
3. The researchers plan to _____ a groundbreaking study on lab-grown organs.
4. The university intends to _____ more labs dedicated to non-animal research.
5. They were able to _____ innovative solutions for non-animal research models.
6. It's essential to _____ thorough investigations into the ethical implications of these new technologies.
7. The pharmaceutical company decided to _____ the challenge of developing non-animal testing methods.
8. The system may _____ if not properly maintained.